Variable Bragg Peak Methodology for Testing Electronic Parts

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The Variable Bragg Peak Method (VBPM) is a new methodology for testing electronic parts for ionizing radiation susceptibility using the Brookhaven National Laboratory (BNL) (Upton, New York) cyclotron. Dr. Patrick Oneill, with collaboration from Dr. Charles Foster and the staff physicists at the BNL, developed the method. The new method uses the high-energy beam at BNL in a way that can characterize the electronic parts without having to de-lid the parts, and will also enable the characterization of thick electronic parts that have been difficult to characterize using other cyclotron sources. The method also enables testing of parts at the board level, although the development of the procedures for this are ongoing.

The specifics of the methodology involved the degradation of a high-energy beam to control the position in space of the Bragg peak. The degradation of the beam is accomplished by a series of plastic masks of varying depths that are controlled by the user (figure 1). Significant modeling of the high-energy heavy ion beam through this material was required to determine the exact nature of the beam contacting the electronic part. As the beam passes through each layer of plastic, the speed (energy) of the beam is diminished and the Bragg peak and consequent linear energy transfer is moved along the x-axis. The Bragg peak is moved through the part until the sensitive volume is characterized. Figure 2 shows a representation of the Bragg peak movement.

This method will make the characterization of some part package types available for the first time while making the characterization process cheaper and more reliable due to not having to de-lid a part for this test.

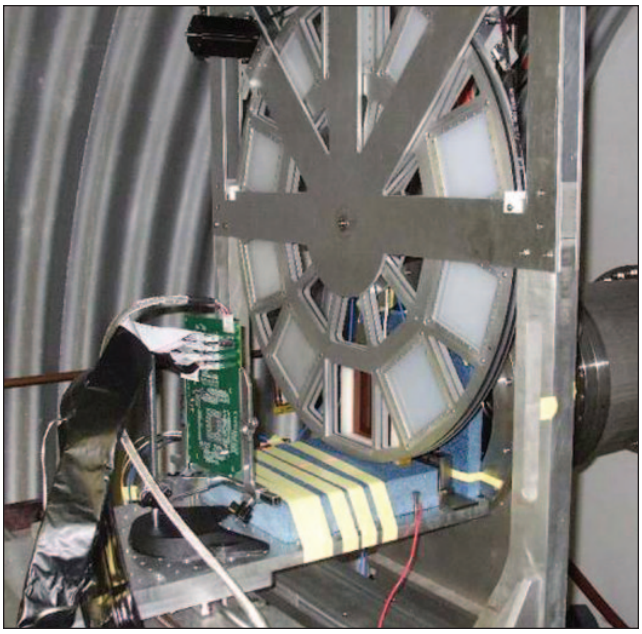

Fig. 1. *Degradation of the high-energy beam is accomplished by a series of plastic masks.*

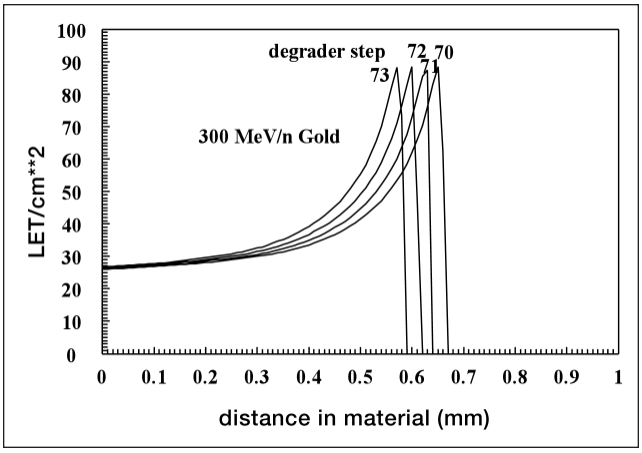

Fig. 2. *Representation of Bragg peak movement.*